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compound precursor, both of which precursors are one of mono- and poly-fluorinated, and both of which precursors have thermosetting groups at both ends that undergo a cross-linking reaction upon thermal treatment.

II. REMARKS

A. Introduction

In this Office Action, claims 1-8 are noted as pending and are rejected based on prior art.

In this Response the written description has been amended to a minor extent to improve its form and clarity, independent claim 1 has been amended, and remarks are provided.

B. Summary of the Invention

The following summary is presented to assist the Examiner in examining the subject application, but is not intended to limit the claims to the summary presented.

A fluorinated polybenzoxazole (PBO) with a high fluorine content has a low dielectric constant, but poor thermal and mechanical properties, and poor solvent resistance. See, e.g., page 1, lines 31-37, page 2, lines 1 and 7-14, and "Comparative Example" on page 7 of the application as filed for a related discussion. Of course, if the fluorine content were low, such properties of the fluorinated PBO would not be poor and, therefore, there would be no need to improve these properties.

The present invention unexpectedly solves the above-discussed inferior properties of a highly fluorinated PBO by introducing thermosetting groups at both ends of fluorinated PBO precursors, yielding a low dielectric constant, as well as excellent thermal and mechanical properties, and good solvent resistance. See page 7, last two lines, over to page 8, lines 1-2 for related support.

In particular, as recited in amended claim 1, the precursors for the polymer or oligomer are an o-aminophenol compound, which is either mono- or poly-fluorinated, and an aromatic dicarboxylic acid compound, again which is either mono- or poly-fluorinated. See, e.g., page 2, lines 15-27, page 3, lines 5-37, page 4, lines 1-10, and Examples 1 and 2. on pages 5 and 6 of the present application. Groups are added at both ends of the polymer oligomer which undergo a cross-linking reaction upon thermal treatment to significantly improve the properties of mechanical strength, etc. See again, e.g., page 2, lines 15-27, as well as page 4, lines 12-22

and Examples 1 and 2 (pages 5-6).

C. Rejection of Claims 1
and 2 Under 35 U.S.C. §103

These claims have been rejected as being made obvious by a combination of Japanese Reference No. 11-236450 (the '450 reference) and Smith et al., U.S. Patent No. 6,124,372 (the '372 reference).

The former is cited for disclosing all recited features, except "none of [the '450 reference's] formulations show the incorporation of thermosetting end groups in the polymer." Office Action, page 3, lines 5-6. Nevertheless, the '372 reference is cited for disclosing the "inclusion of thermosetting end groups onto polymers...to enable cross-linking". Office Action, page 3, lines 7-8.

In response, it is respectfully submitted that the present invention, as recited by amended claims 1 and 2, was not made obvious by the cited prior art for the following reasons.

As discussed above, in order to obtain mechanically strong, solvent-resistant, fluorinated PBO polymers with low dielectric constant, the precursors of the fluorinated PBO polymers of the present invention are end-capped with thermosetting groups.

The '450 reference discloses fluorinated PBO's synthesized from o-aminophenols and aromatic dicarboxylic acids. Compare formulae (1) and (2) with the fluorinated rings on page 2. If the fluorine content in the '450 reference's monomers is high, especially if both monomers contain fluorinated groups, it is very difficult to synthesize PBO polymers with sufficiently high molecular weights, due to the low nucleophilicity of the fluorine-containing monomers or, in other words, the electron-withdrawing effect of the fluorinated groups. This would give PBO polymers of poor mechanical properties such as tensile strength. Moreover, if such polymers having high fluorine content were cured, the cured polymers would be solvent susceptible and, therefore, it would be extremely difficult to apply these polymers in multilayer circuit boards. As acknowledged by the Examiner, the '450 reference fails to suggest a need or a means for any end capping.

Thus, the issues are whether the art recognizes the problem sought to be solved by the present invention, and whether the '372 reference obviously teaches a reasonable manner for modifying the '450 reference to solve the problem, i.e., to add end caps to avoid the problems caused by a highly fluorinated PBO precursor. It is respectfully submitted that the answer is no.

The '372 reference mentions very generally PBO's. The fluorine content is low or non-existent in the '372 reference (see, e.g., "Example 1", Col. 109), so the mechanical properties of the PBO's, even if fluorinated, would not be poor and, therefore, there would be no necessity or other motivation to improve the mechanical properties thereof, as discussed above.

Accordingly, the '372 reference neither discloses nor teaches that end capping groups are introduced into a PBO polymer by way of an o-aminophenol compound precursor and an aromatic dicarboxylic acid compound precursor, both of which are fluorinated for lowering the dielectric constant, in order to improve mechanical properties, etc.

D. Rejection of Claims 1-8
Under 35 U.S.C. §103

Claim 1-8 have been ejected under 35 U.S.C. 103(a) as being unpatentable over Murayama et al. , U.S. Patent No. 6,297,351 (the '351 reference), in view of the '372 reference.

Again, for the reasons stated above in relation to claim 1, from which claims 2-8 depend, and for the following reasons, it is respectfully submitted that the present invention, as recited by claims 1-8, was not rendered obvious by the cited combination.

The '351 reference discloses that fluorinated PBOs are, as with the '450 reference discussed above, synthesized from o-aminophenols and aromatic dicarboxylic acids. However, again like the '450 reference, the '351 reference neither teaches nor suggests the need for or the manner of introducing thermosetting end groups into the fluorinated PBO precursors, and therefore the fluorinated PBO polymers of the '351 reference should exhibit the same defects as those of the '450 reference, discussed above.

Again, as discussed above, since the '372 reference has at most low fluorine content, there is no need to improve, e.g., the mechanical properties, by end caps, or other means.

III. CONCLUSION

In light of the above amendments and remarks, it is respectfully submitted that the claims are now in condition for allowance.

If there are any additional fees associated with this Response, please charge same to our Deposit Account No. 19-3935.

Finally, if there are any formal matters remaining after this Response, the undersigned would appreciate a telephone conference with the Examiner to attend to these matters.

Respectfully submitted,

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6/21/02

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE
37 C.F.R. §121(b) and/or(c)**

A. IN THE SPECIFICATION:

Please replace the written description with the SUBSTITUTE SPECIFICATION attached.

A marked-up version of same is also attached for the Examiner's convenience.

B. IN THE CLAIMS:

Please AMEND the following claim:

1. (ONCE AMENDED) A thermally curable fluorinated o-aminophenol polymer or oligomer based on an o-aminophenol compound precursor and an aromatic dicarboxylic acid compound precursor, [at least one of which is] both of which precursors are one of mono- [or] and poly-fluorinated, and [having] both of which precursors have thermosetting groups at both ends that undergo a cross-linking reaction upon thermal treatment.